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Two-parameter Elastic-plastic Fracture Criterion Based on *J*-*A* Theory

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Using *J*-*A* theory the crack-tip stress field in an elastic-plastic material is described by the three-term asymptotic expansion which is controlled by two parameters – the *J*-integral and the amplitude *A*. The second amplitude parameter *A* can be interpreted as a geometry constraint parameter. The *J*-integral value is determined by the equivalent domain integral method. The amplitude *A* is estimated with least square fitting of numerical stress data. The weakest link model is applied for predicting geometry dependence of the fracture toughness $J_C(A)$. It is shown that normalization of the amplitude parameter *A* by its small-scale yielding value A_{SSY} leads to fracture toughness approximations $J_C(A/A_{SSY})$ that are nearly independent of material hardening power. A two-parameter elastic-plastic fracture criterion is formulated in the form $J(A) = m(A) \cdot J_C(A_{SSY})$, where $m(A)$ is a constraint multiplier for fracture toughness and $J_C(A_{SSY})$ is fracture toughness for small-scale yielding conditions.

Keywords: Elastic-plastic fracture, Three-term asymptotic expansion, *J*-integral